

## Te Hiku

Lake Kihona (Aupouri), NRC Lake No. 31.



**Lake Kihona** is situated in a plantation pine forest catchment with a buffer of mānuka/kānuka scrub and tall emergent vegetation (2023 Inigo Zabarte-Maeztu).

Summary	Lake Kihona
<b>Surveyed:</b>	2004, 2017 and 2023.
<b>Overall ranking:</b>	<b>High:</b> Intact emergent vegetation and scrub buffer this lake from runoff from the pine dominated catchment. The Nationally Critical bladderwort, <i>Utricularia australis</i> was abundant and the lake is now only one of two that support healthy populations of this species in Northland. Characean meadows were the dominant vegetation, mostly replacing invasive hornwort areas the dominant vegetation in 2004.
<b>Threats:</b>	Hornwort is present but is no longer a dominant species in this lake. Hornwort may increase in response to future catchment disturbances. Alligator weed is present at the outlet stream.
<b>Management recommendations:</b>	Provide advice to forestry companies to modify activities in the lake catchment to minimise future nutrient enrichment or impacts on water clarity. Do not seek to control hornwort as this could impact on the bladderwort population. Regular water quality monitoring and ecological assessments are recommended including the abundance and extent of bladderwort.

## Description

This dune lake (1591072E, 6168119N) is formed from a gully system dammed by sand dunes to the west and is 7.8 ha in size and 8.3 m deep. The catchment is pine plantation forest (logged in 2004) with a mānuka/kānuka scrub buffer between the lake and pines. The inflow stream enters the north-eastern end of the lake, with the outlet (Pukekura Stream) discharging to the west coast 5 km to the south-west. Access is through approximately 10 km of eroded forestry roads to the outlet. Small boat access has become very difficult with over growing vegetation and erosion of the tracks.

## Wetland vegetation

A margin of emergent vegetation up to 20 m across was present with *Eleocharis sphacelata* the dominant species, present around most of the lake growing to a depth of 2.3 m. *Typha orientalis*, *Machaerina articulata*, *M. juncea*, *Cyperus ustulatus*, *Carex secta*, *C. virgata*, *C. maorica*, *Phormium tenax* and *E. acuta* were also present.

Alligator weed (*Alternanthera philoxeroides*) was present at one transect near the outlet stream.

## Submerged vegetation

In 2023, charophyte meadows (>75% cover) of *Chara australis* were present on all five profiles to a maximum depth of 4.5 m. Tall growing *Myriophyllum propinquum* (to 1.5 m tall) was found on two profiles with a maximum depth of 5 m. *Utricularia australis* was present on all five profiles. It grew to 4 m deep and up to 1.3 m tall, with median cover class of 26-50%.



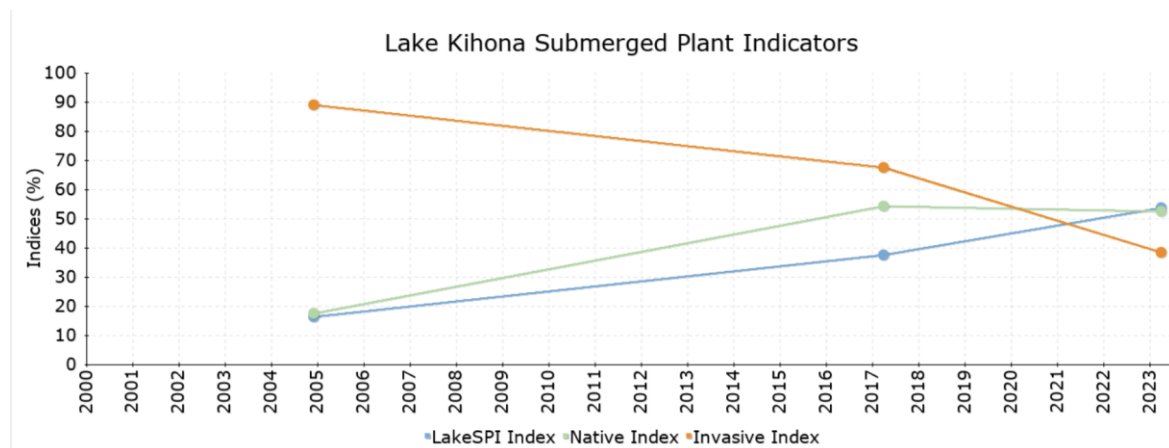
**Lake Kihona:** the Critically Endangered *Utricularia australis*, common in the submerged vegetation of this lake (2023 Inigo Zabarte-Maeztu).

The highly invasive non-native weed hornwort (*Ceratophyllum demersum*) was scarce in the lake, only occurring on one profile, with a cover of <5%. The invasive *Utricularia gibba* was present in all profiles, extending to a depth of 2.6 m in one transect but around 1 m depth in the other four profiles, with median covers of <25%. Underwater clarity was poor, often less than 1 m.

Similar vegetation was recorded in 2017, with a maximum depth of 5 m, charophyte meadows of *Chara australis* dominating and deeper growing *Utricularia australis* (to 5.1 m deep and up to 2.6 m tall) present on four of the five profiles. Hornwort was present on four of the five profiles in 2017 but did not form the dense high cover weed beds described in 2004 and had reduced in average cover (to about 10%) since the earlier survey.

Submerged vegetation in 2017 and 2023 contrasted markedly with that of indicative results from three profiles surveyed in 2004 when the pine catchment was being harvested. In 2004, the lake vegetation was dominated by the invasive weed hornwort, present throughout the lake with a maximum cover of 100% on all three profiles. *Chara australis* was present but at low (<5%) average covers and did not form meadows. *Utricularia australis* was recorded on only one of the three profiles and at ≤5% maximum cover.

## LakeSPI



Survey Date	Status	LakeSPI %	Native Condition %	Invasive Impact %
March 2023	High	53.7%	52.4%	38.5%
March 2017	Moderate	37.6%	54.3%	67.4%
November 2004	Poor	16.3%	17.5%	88.9%

**LakeSPI Index for Lake Kihona as % of potential score since 2004.** Native Condition Index, and Invasive Impact Index are also shown.

In 2023, the LakeSPI Index and Native Condition Index were High (54 and 52% respectively), with an Invasive Impact Index of 39% predominantly based on the impact of *Utricularia gibba*. The LakeSPI Index suggests an improvement over the monitoring period, with a High LakeSPI Index in 2023, Moderate Index in 2017 and a provisional Poor index in 2004. The reduction in abundance of hornwort has predominantly driven these changes.

## Water birds

Lake Kihona provided good water bird habitat. In 2017, grey duck (*Anas superciliosa*), black swan (*Cygnus atratus*), dabchick (*Poliocephalus rufopectus*) and pied shag (*Phalacrocorax varius*) were seen. In 2004, black swan, pied shag and shoveler (*Anas rhynchotis*) were seen. Fernbird (*Bowdleria punctata vealeae*) were previously recorded in 1991 (DOC SSBI) but were not noted by our surveys or the 1996 OSNZ survey. Past logging would have caused major disruption of the lake and its surrounding vegetation.

## Fish

Shortfin eel (*Anguilla australis*) and common bully (*Gobiomorphus cotidianus*) were seen during previous 2017 and 2004 vegetation surveys, with bullies reported in 2023. DOC SSBI also reported grey mullet (*Mugil cephalus*) in this lake.

## Aquatic invertebrates

No koura or mussels were found during any surveys.

## Endangered species

The Nationally Critical bladderwort *Utricularia australis* was rare in 2004, with <5% cover at only one of the three profile sites. In 2017, it was common on four of the five profiles and was present in all five transects in 2023, albeit with a slightly reduced maximum depth and height compared to 2017. Lake Kihona is one of only two lakes surveyed in Northland that still supports large populations of this species.

Threatened bird species reported from the lake in 2017 included Nationally Vulnerable grey duck (*Anas superciliosa*), Nationally Threatened -Increasing dabchick (*Poliocephalus rufopectus*) and At-Risk Recovering pied shag (*Phalacrocorax varius*).

## Lake Ecological Value

In 2023, the Ecological Value of Lake Kihona was rated as High (11). The condition of this lake has improved from a rating of Moderate in 2004, and High to Moderate in 2017. The increased buffering of the lake (native catchment and emergent vegetation extent), indigenous aquatic vegetation diversity and Native Condition Index contribute to the improved condition, despite still recording the most invasive of submerged plants, hornwort.

## Threats

The lake is isolated with difficult access at present, however both hornwort and alligator weed have been introduced in the past; the former probably with eel nets, the latter via a digger used to deepen the outlet as an emergency water supply for forest fire management.

Forestry activities such as fertiliser application and logging within the catchment can markedly affect the nutrient status of the lake.

## Management recommendations

The lake is a significant habitat for the rare indigenous plant *U. australis* so warrants special consideration regarding future impacts from catchment activities that impact lake water quality and clarity. Advice should be provided to forestry companies to modify activities in the lake catchment to minimise future nutrient enrichment or impact on water clarity.

Control of hornwort is not currently advocated, as there has been a reduction in its impact

and extent, presumably due to the dystrophic nature of the water body. *U. australis* is currently thriving in Lake Kihona and may be adversely impacted by any attempt to control hornwort.

Annual monitoring of the critically threatened *Utricularia australis* population is required under the National Policy Statement – Freshwater Management.

Regular water quality monitoring is advocated, as are regular ecological assessments (three to five yearly).